

# A Report on U.S., EN & IEC Standards Development on Bonding and Grounding Infrastructure for Telecommunications

Targeting Drafts TIA 607-C and ISO/IEC 30129

William Bush MBA; NCE

(wbush@ieee.org)

Industry Consultant

PQ, EMC, Lightning, Surge, Grd/Bond

ATIS PEG 2015 – Huntsville, AL

# Main Points

- **TIA 607-B shopped and accepted into EN 50310 to develop draft IEC 30129**

- **TIA 607-B**

Generic Telecommunications Bonding and Grounding  
(Earthing) for Customer Premises

## **IEC 30129**

Telecommunications Bonding Networks for Buildings and  
Other Structures (??)

# Main Points - 2

- **IEC 30129 has two acceptable methodologies**
  - 1) **Resistance: based upon TIA 607-B**
  - 2) **Impedance: based upon EN 50130**
- **TIA 607-C draft intended to also meet IEC 30129 requirements**

# Main Points - 3

- Effectively, TIA 607 works (including the TIA/ATIS Joint Std TIA 607-A) are a basis for an Int'l standard IEC 30129
- ATIS did not rejoin TIA in the draft for TIA-607-B
- TIA 607-B developed by TIA cabling WG 42.16

# Main Points - 4

- **Very few of the SMEs from TIA-607 & 607-A participated in WG 42.16**
- **WG 42.16 heavily influenced by manufacturers and non-SMEs**
- **TIA 607-B developed with related information from NECA, BICSI and other TIA standards**

# Main Points - 5

- **TIA 607-B further increases size of TBB**
- **TIA 607-B recommends bonding grid for computer rooms and a mesh-BN network**
- **TIA 607-C to add extra TBB parallel leads – claiming decreased HF impedance**

# Main Points – 6

- **What has really happened??**
  - More wires and increased wire size
  - Endorsement of bonding grid added to mesh-BN
    - For all installations
  - Increased claims to lower wiring impedance
  - Dependence on resistance testing alone for verification of wiring system
  - For IEC, dependence on added parallel wires to accomplish impedance control for HF
  - ATIS SME contributions compromised

# The Relevant Standards

- **TIA 942; NECA/BICSI 607; BICSI 002**
  - Influencing standards on TIA 607-B
- **TIA 607-B & addendum “Structural metal”**
- **ISO/IEC 30129 draft**
  - EN 50310 and TIA 607-B harmonization
- **TIA 607-C**



# Noted standards activity

## What BICSI, TIA & ISO/IEC are Doing With Standards and Why You Should Care

Jonathan Jew - J&M Consultants, Inc.

### The organizations in this update

- **ISO/IEC** – ISO/IEC JTC 1 SC 25 WG 3 – international telecommunications cabling standards
- **TIA** (Telecommunications Industry Association) TR-42 – US and Canadian national telecommunications cabling standards
- **BICSI** – international standards and guidelines for information technology systems



# Noted standards activity - 2

## ISO/IEC In Progress

- **3<sup>rd</sup> Edition of ISO/IEC 11801 series** & reorganization of related standards (-1 General, -2 Offices, -3 Industrial, -4 Homes, -5 Data Centres) estimated publication 2016 – no more Cat 3, OM1, OM2. **For those who use ISO/IEC standards**
- **ISO/IEC 30129 – Telecommunications Bonding** - New standard based on ANSI/TIA-607-B and CENELEC EN 50310 - estimated 2015-2016 - **For those who specify telecom bonding & grounding**



# Noted standards activity - 3

## TIA – Published in 2013 & 2014

- **ANSI/TIA-607-B-2 – Structural Metal Addendum**

- Harmonizes with ISO/IEC 30129 Telecom Bonding standard in development
- Permits the use of an electrically continuous **building structural metal frame to be used in place of a dedicated telecommunications bonding backbone**
- **For those who design or specify telecom bonding**

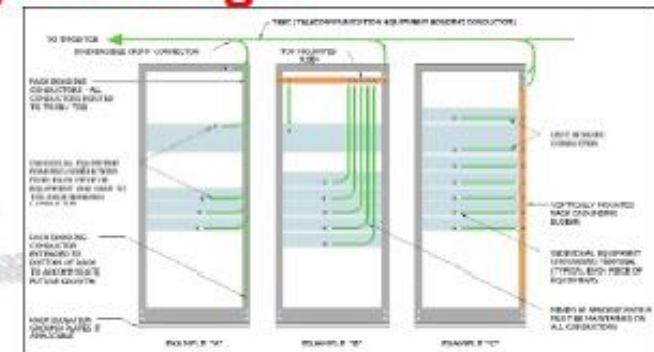


**Bicsi**

# Noted standards activity - 4

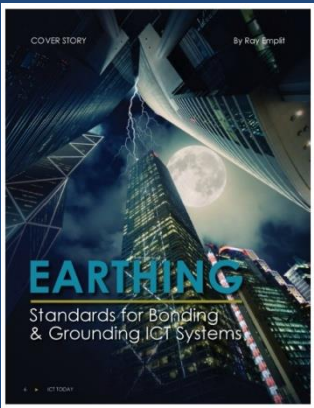
## TIA Standards in Development

- **TIA-607-C bonding and grounding (earthing)**  
update to TIA-607-B - harmonize with ISO/IEC 30129 where possible, integrate annexes on antenna grounding and building steel
- **For those who specify telecom grounding & bonding**
- Estimated 2015



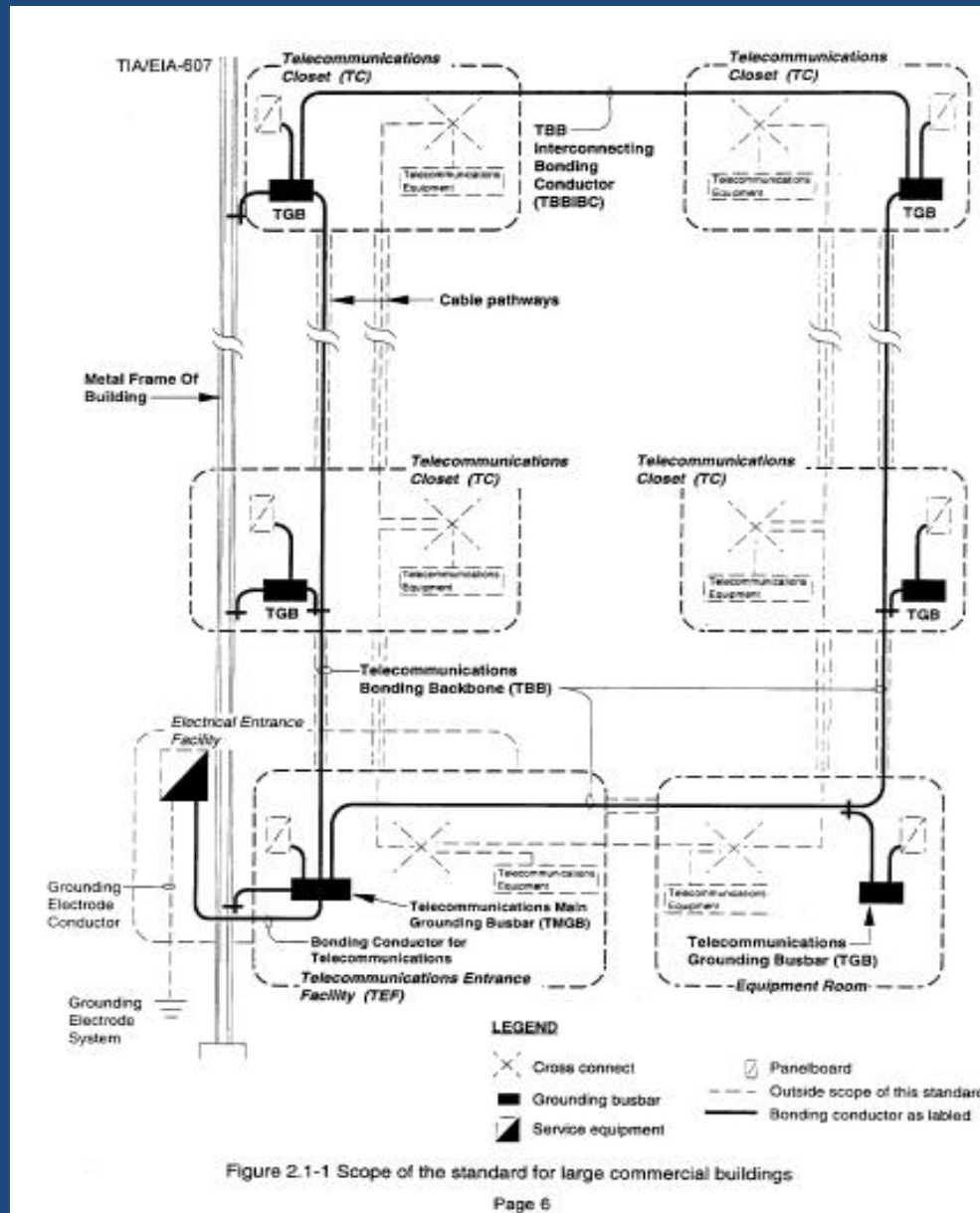
# BICSI's *ICT* Article on Standards for Bonding & Grounding ICT Systems (Nov/DEC 2014)





- **Good summary article on evolution of TIA 607 into TIA 607-C**
- **Input of TIA 607-B materials into IEC 30129**
- **Harmonization of TIA 607-C with IEC 30129**
- **Separate file – onscreen quick look**

# TIA 607 Diagram



# TIA 607-A Diagram

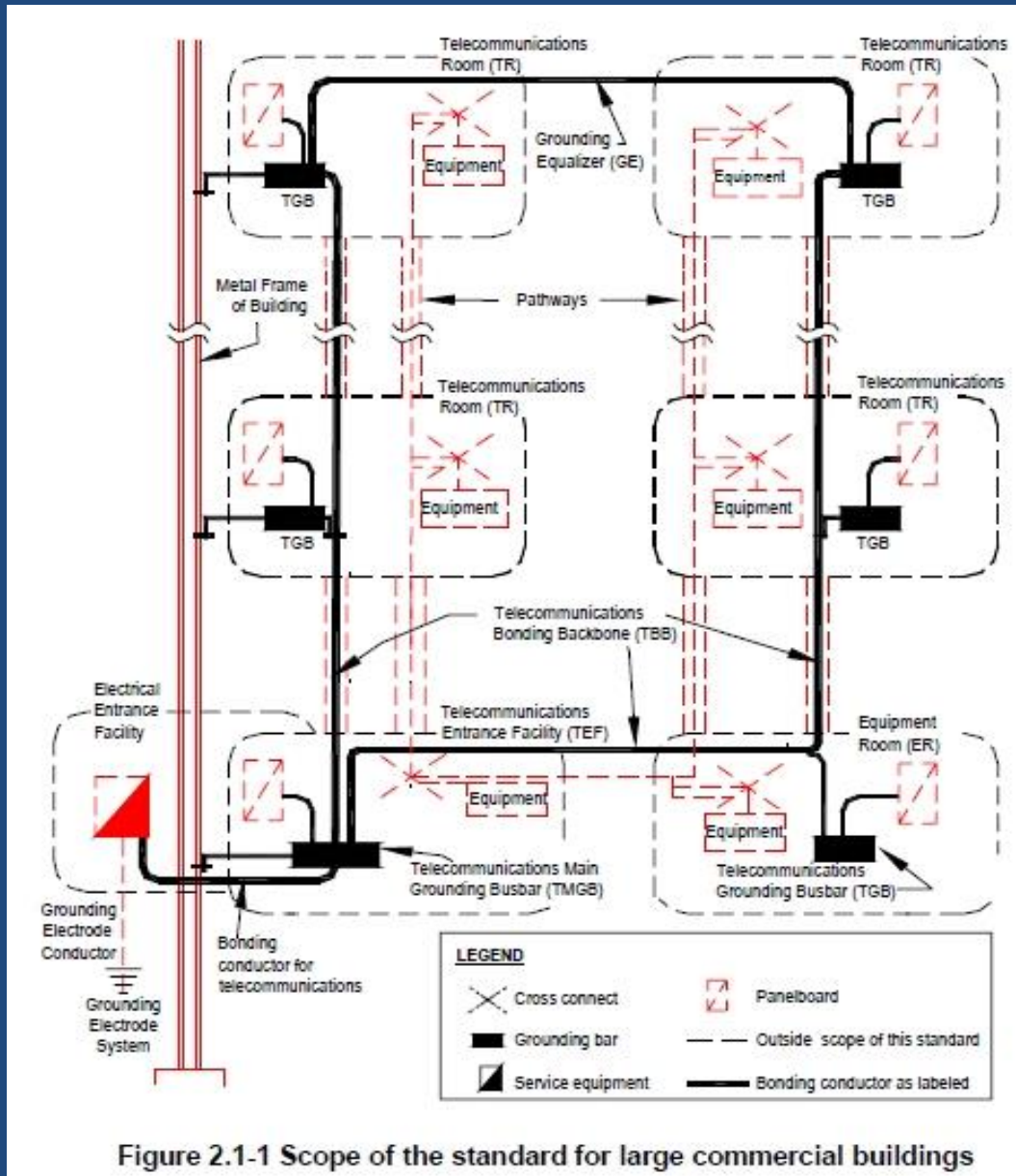


Figure 2.1-1 Scope of the standard for large commercial buildings



# TIA 607-B Diagram

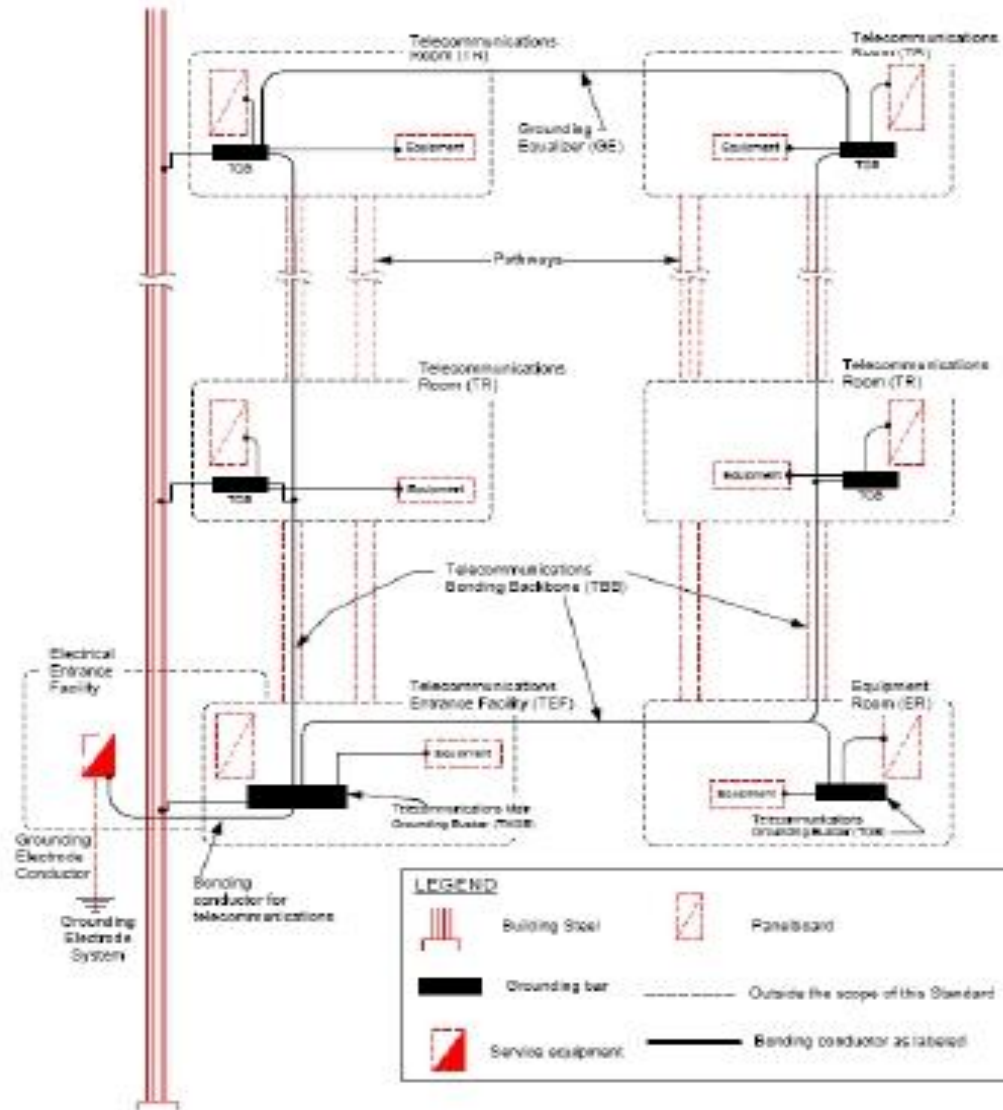


Figure 2 – Illustrative example of a larger building

1 CONTENTS

2 1 Scope ..... 8

3 2 Normative references ..... 8

4 3 Terms, definitions and abbreviations ..... 9

5 3.1 Terms and definitions ..... 9

6 3.2 Abbreviations ..... 11

7 3.3 Conventions ..... 11

8 4 Conformance ..... 12

9 5 Assessment of bonding networks ..... 12

10 5.1 Overview ..... 12

11 5.2 Assessment of the impact of the telecommunications bonding network on the

12 interconnection of telecommunications equipment ..... 13

13 5.3 Telecommunication bonding networks ..... 15

14 5.4 Telecommunications bonding network performance ..... 15

15 5.4.1 Requirements ..... 15

16 5.4.2 Measurement of bonding network performance ..... 16

17 6 Common features ..... 19

18 6.1 General ..... 19

19 6.2 Protective bonding networks ..... 19

20 6.2.1 Protective bonding network conductors (PNBCs) ..... 19

21 6.2.2 Main Earthing Terminal (MET) ..... 19

22 6.3 Telecommunications bonding networks ..... 19

23 6.3.1 Conductor cross-sectional areas ..... 19

24 6.3.2 Telecommunications Entrance Facility (TEF) ..... 19

25 6.4 Telecommunications bonding network components ..... 20

26 6.4.1 Telecommunications bonding network conductors ..... 20

27 6.4.2 Telecommunications bonding network connections ..... 20

28 6.5 Cabinets, frames and racks ..... 21

29 6.5.1 External connections to a bonding network ..... 21

30 6.5.2 Rack bonding conductors ..... 22

31 6.5.3 Internal connections ..... 22

32 6.6 Bonding connections between telecommunications cabling infrastructure

33 components ..... 23

34 6.6.1 Bonding conductors for d.c. resistance control ..... 23

35 6.6.2 Bonding conductors for impedance control ..... 23

36 6.7 Documentation ..... 24

37 7 Dedicated telecommunications bonding network ..... 25

38 7.1 General ..... 25

39 7.2 Components ..... 26

40 7.2.1 Primary bonding busbar (PBB) ..... 26

41 7.2.2 Secondary bonding busbar (SBB) ..... 26

42 7.2.3 Bonding conductors for d.c. resistance control ..... 27

43 7.2.4 Bonding conductors for impedance control ..... 28

44 7.3 Implementation ..... 28

45 7.3.1 Primary bonding busbar (PBB) ..... 28

46 7.3.2 Secondary bonding busbar (SBB) ..... 29

47 7.3.3 Telecommunications Bonding Conductor (TBC) ..... 30

48 7.3.4 Telecommunications Bonding Backbone (TBB) ..... 30

# IEC 30129 draft - Scope

49	7.3.5	Backbone Bonding Conductor (BBC).....	30
50	7.3.6	Bonds to continuous conductive pathway systems.....	30
51	7.3.7	Bonds to structural metalwork.....	31
52	8	Local telecommunications bonding networks in conjunction with protective bonding networks.....	32
53			
54	8.1	Bonding for local distribution.....	32
55	8.1.1	Star protective bonding networks.....	32
56	8.1.2	Ring protective bonding networks.....	33
57	8.2	Telecommunications bonding conductors.....	34
58	8.2.1	Bonding conductors for d.c. resistance control.....	34
59	8.2.2	Bonding conductors for impedance control.....	34
60	8.3	Bonding for areas of telecommunications equipment concentration.....	35
61	8.3.1	Local mesh bonding networks.....	35
62	8.4	Areas of equipment concentration.....	36
63	9	Local telecommunications bonding networks in conjunction with dedicated telecommunications bonding networks.....	37
64			
65	9.1	Bonding for areas of telecommunications equipment concentration.....	37
66	9.1.1	Requirements.....	37
67	9.1.2	Recommendations.....	37
68	9.1.3	Cabinets, frames and racks.....	37
69	9.2	Telecommunications bonding conductors.....	37
70	9.2.1	Telecommunications equipment bonding conductor (TEBC).....	37
71	9.2.2	Bonding conductor for connections to the supplementary bonding network.....	38
72	9.3	Implementation.....	38
73	10	Mesh bonded networks.....	40
74	10.1	General.....	40
75	10.2	MESH-BN.....	40
76	10.2.1	General.....	40
77	10.2.2	Implementation.....	41
78	10.2.3	MESH-IBN.....	41
79	10.2.4	Supplementary bonding grid (SBG).....	42
80	10.2.5	System Reference Potential Plane (SRPP).....	43
81	Annex A	Galvanic corrosion.....	45
82	A.1	General.....	45
83	A.2	Requirements.....	45
84	Annex B	Bonding conductor cross-sectional area.....	46
85	Bibliography.....		47
86			
87	<b>List of figures</b>		
88	Figure 1	– Schematic relationship between ISO/IEC 30129 and other relevant standards.....	7
89	Figure 2	– Schematic of telecommunications equipment distribution and telecommunications bonding network terminology.....	13
90			
91	Figure 3	– Sensitivity of cabling media to bonding network performance.....	14
92	Figure 4	– Example of three methods of equipment and rack bonding.....	21
93	Figure 5	– Example of a bond connection from a cabinet to the cabinet door.....	23
94	Figure 6	– Example of bonding straps.....	24
95	Figure 7	– Illustrative example of a large building.....	25
96	Figure 8	– Illustrative example of a smaller building.....	26

# IEC 30129 draft - Scope

# IEC 30129 draft - Scope

- 4 -

30129/WD4 © ISO/IEC

97	Figure 9 - Schematic of PBB .....	26
98	Figure 10 - Schematic of SBB .....	26
99	Figure 11 - Star protective bonding and supplementary telecommunications bonding .....	32
100	Figure 12 - Example of high common Impedance and large loop.....	32
101	Figure 13 - Example of low common Impedance and small loop.....	33
102	Figure 14 - Ring protective bonding and supplementary telecommunications bonding.....	33
103	Figure 15 - Mesh-BN example.....	34
104	Figure 16 - Local mesh bonding network .....	35
105	Figure 17 - Example TEBC to rack bonding conductor connection .....	39
106	Figure 18 - Example of a TEBC routed on cable tray.....	39
107	Figure 19 - A MESH-BN with equipment cabinets, frames, racks and CBN bonded together .....	40
108	Figure 20 - A MESH-IBN having a single point of connection.....	42
109	Figure 21 - Example of access floor.....	44
110	Figure 22 - Example of installation details for an under floor transient suppression plate.....	44
111		
112	<b>List of tables</b>	
113	Table 1 - Telecommunications bonding network requirements.....	14
114	Table 2- d.c resistance requirements for protective bonding networks.....	16
115	Table 3- Impedance/frequencies requirements for protective bonding networks .....	16
116	Table 4- d.c resistance requirements for telecommunications bonding networks .....	17
117	Table 5- Impedance/frequencies requirements for telecommunications bonding networks.....	17
118	Table 6 - TBB conductor sizing .....	27
119		
120	Table B.1 - Bonding conductor equivalents.....	46
121		

# IEC 30129 draft - Scope

## 1 Scope

This International Standard specifies requirements and recommendations for the design and installation of connections (bonds) between various electrically conductive elements in buildings and other structures in which information technology (IT) and, more generally, telecommunications equipment is intended to be installed in order to

- a) minimise the risk to that equipment and interconnecting cabling from electrical hazards,
- b) provide the telecommunications installation with
  - a reliable signal reference,
  - improved immunity from electromagnetic interference.

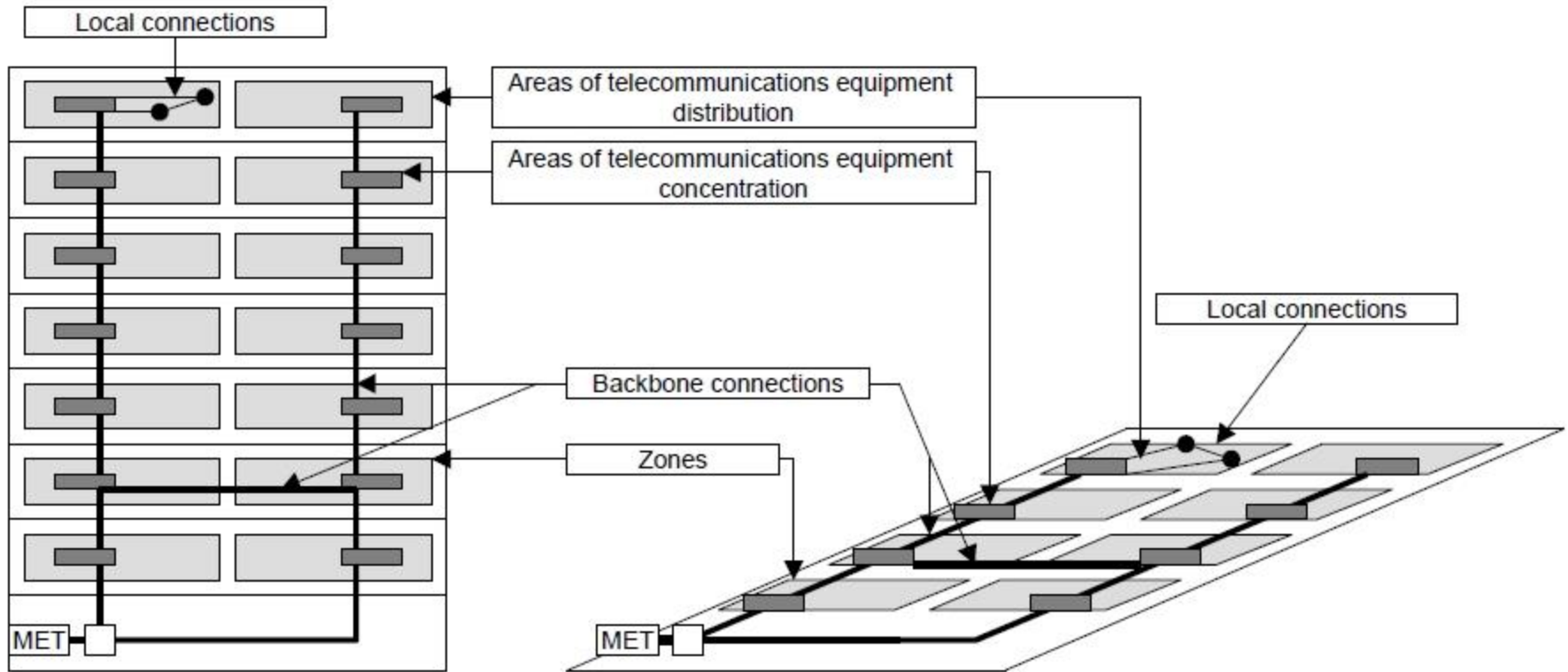
The requirements of this International Standard are applicable when telecommunications cabling installations are planned for new constructions and during the refurbishment of buildings.

The requirements of this International Standard are applicable to the types of buildings and structures addressed by ISO/IEC 14763-2 (e.g. residential, office, industrial premises and data centres) but information given in this International Standard may be of assistance for other types of buildings and structures.

# IEC 30129 draft – Figure 2

30129/WD4 © ISO/IEC

– 13 –



**Figure 2 - Schematic of telecommunications equipment distribution and telecommunications bonding network terminology**

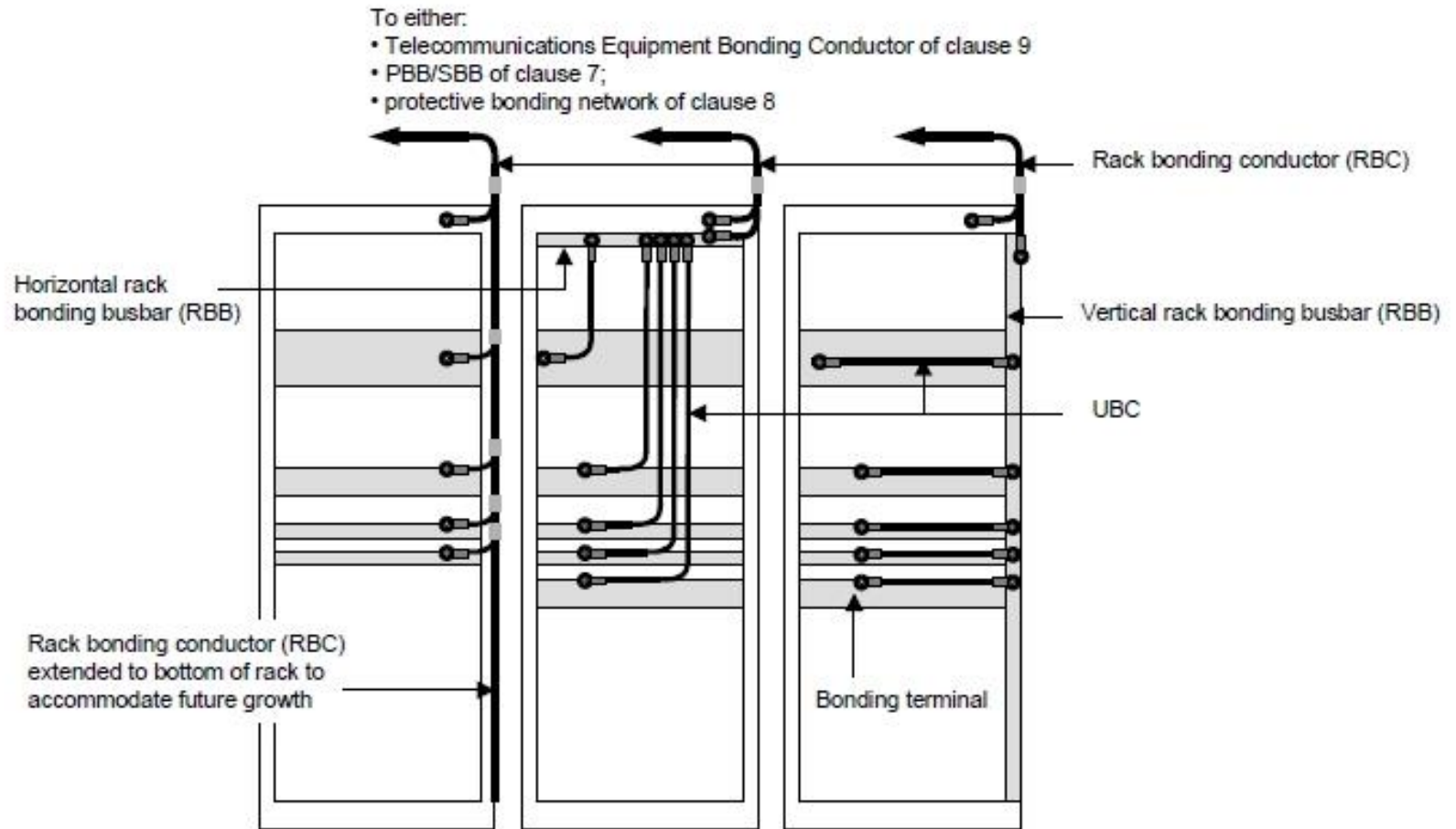
# IEC 30129 draft – Table 1

**Table 1 - Telecommunications bonding network requirements**

Editors note: the current content of this table are only intended to highlight the general mechanism for referencing the requirement of later chapters

Media		Transmission (subject to maximum channel length limits)	
		Between any zones	Within a zone
Asymmetric cabling	Using protective bonding network	d.c resistance and impedance control requirements of clause 8	d.c resistance and impedance control requirements of clause 8
	Using dedicated telecommunications bonding network	d.c resistance and impedance control of clause 7	d.c resistance and impedance control of clause 9
Symmetric cabling (unbalanced applications)	Using protective bonding network	d.c resistance control requirements of clause 8	d.c resistance control requirements of clause 8
	Using dedicated telecommunications bonding network	d.c resistance control of clause 7	d.c resistance control of clause 9
Symmetric cabling (screened)	Using protective bonding network	d.c resistance control requirements of clause 8	d.c resistance control requirements of clause 8
	Using dedicated telecommunications bonding network	d.c resistance control of clause 7	d.c resistance control of clause 9
Symmetric cabling (unscreened)	Using protective bonding network	d.c resistance control requirements of clause 8	d.c resistance control requirements of clause 8
	Using dedicated telecommunications bonding network	d.c resistance control of clause 7	d.c resistance control of clause 9
Optical fibre		No requirements	No requirements

# IEC 30129 draft – Figure 4



**Figure 4 - Example of three methods of equipment and rack bonding**



# IEC 30129 draft – Figure 7

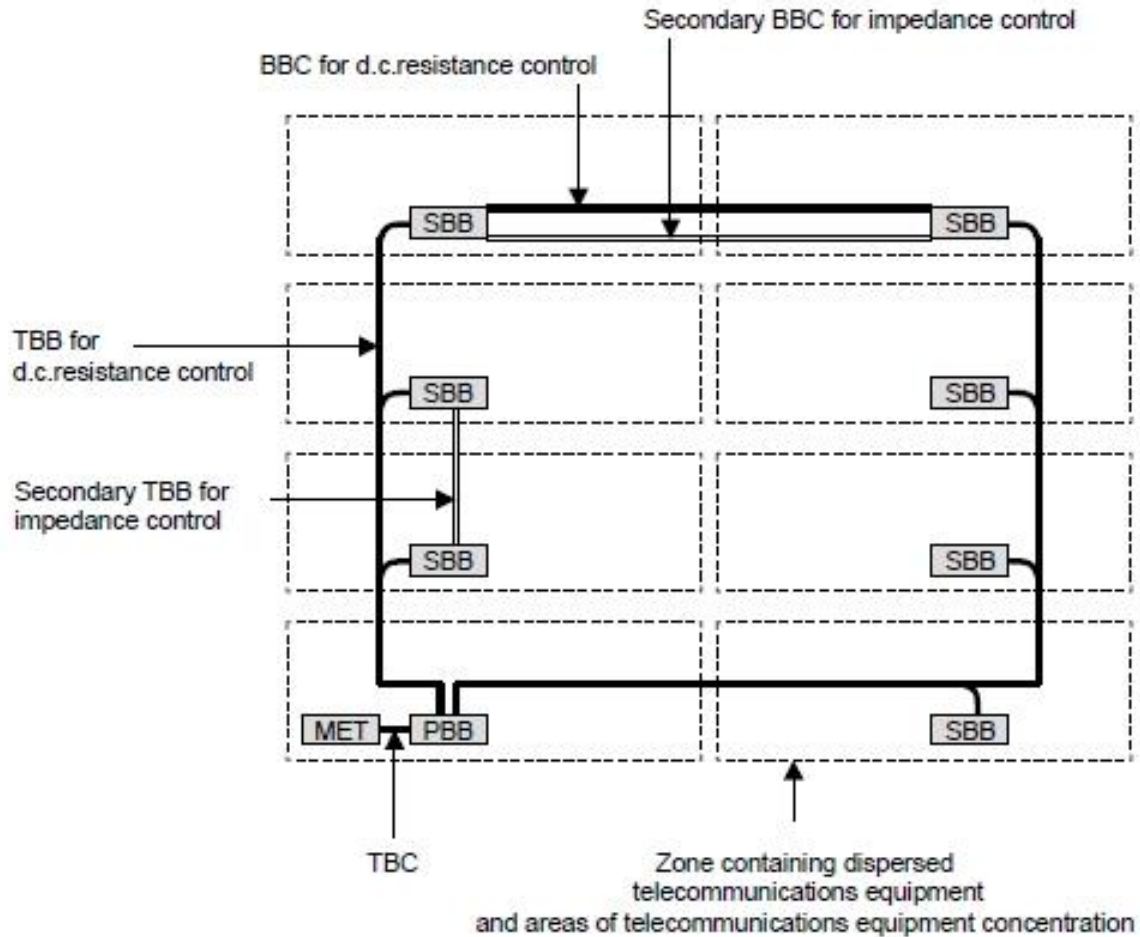


Figure 7 - Illustrative example of a large building

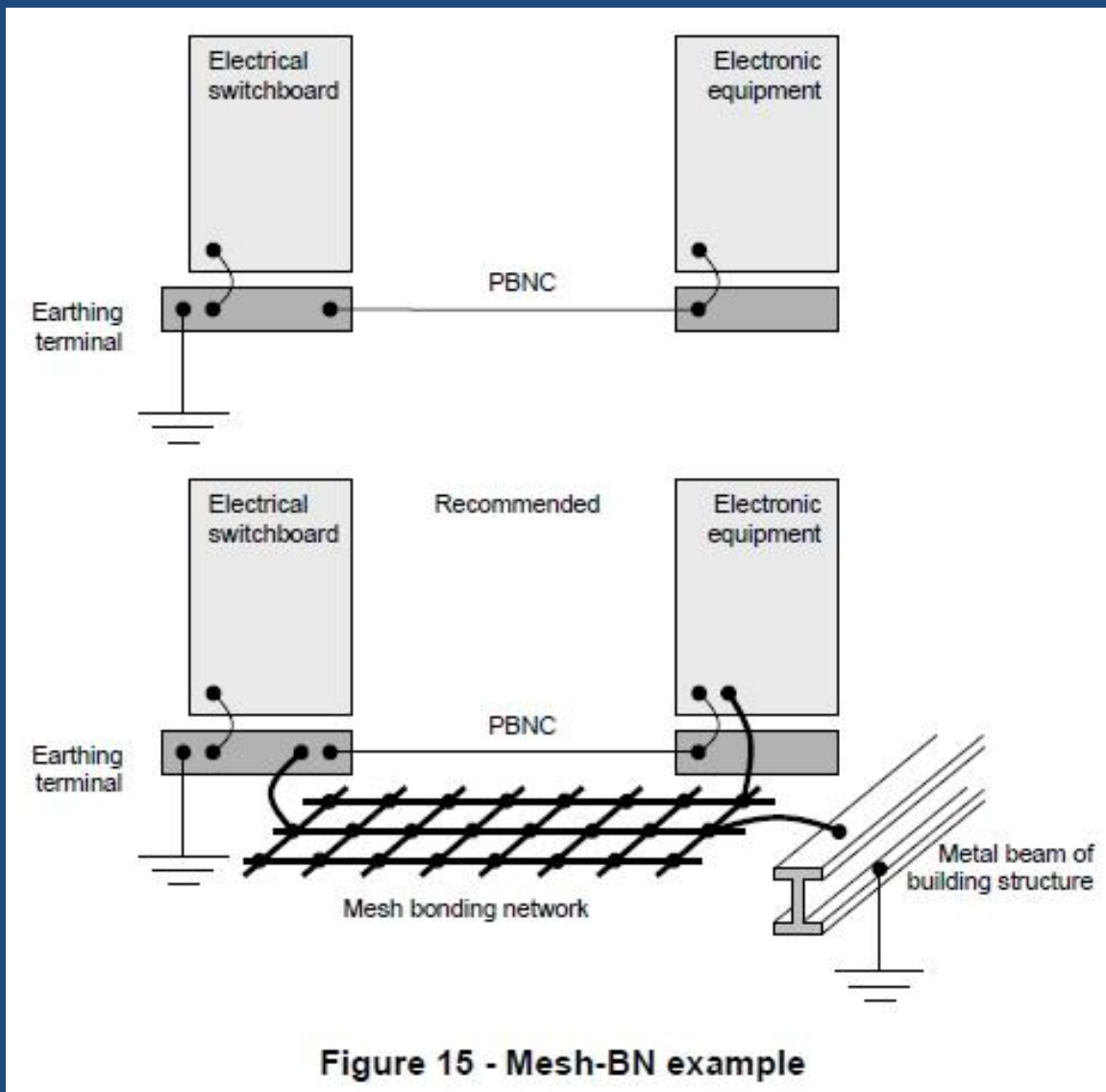
# IEC 30129 draft – Figure 7

To provide optimum d.c. resistance control the TBB should be constructed from conductors in accordance with Table 6.

**Table 6 - TBB conductor sizing**

Maximum PBB-SBB length $l$ (m)	Conductor cross-sectional area (mm <sup>2</sup> , min)
$l \leq 4$	13
$4 < l \leq 6$	21
$6 < l \leq 8$	26
$8 < l \leq 10$	33
$10 < l \leq 13$	42
$13 < l \leq 16$	53
$16 < l \leq 20$	67
$20 < l \leq 26$	84
$26 < l \leq 32$	107
$32 < l \leq 38$	125
$38 < l \leq 46$	150
$46 < l \leq 53$	175
$53 < l \leq 76$	250
$76 < l \leq 91$	300
For lengths in excess of those shown above, the conductor cross-sectional area shall be calculated as 3,3 mm <sup>2</sup> per metre	

# IEC 30129 draft – Figure 15



# IEC 30129 draft – Figure 16

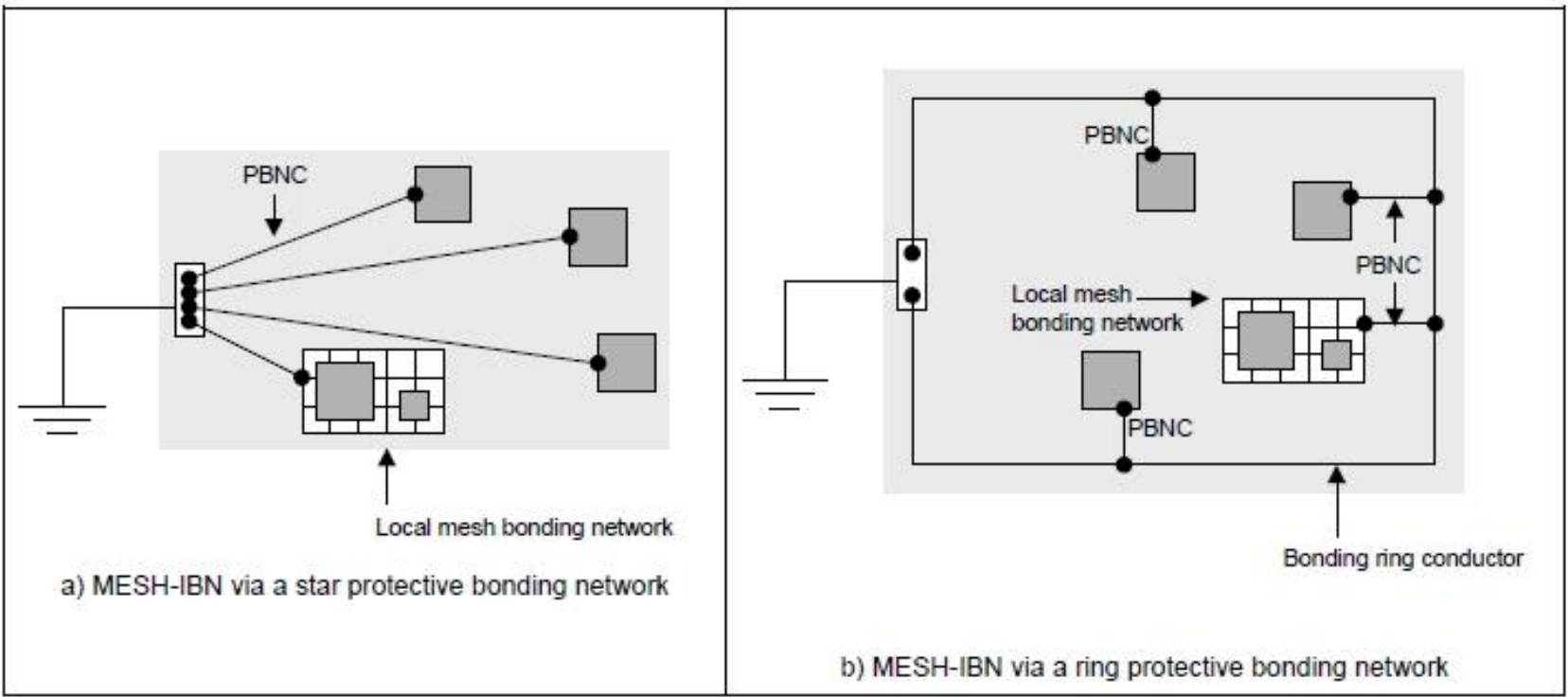


Figure 16 - Local mesh bonding network

# IEC 30129 draft – Figure 16

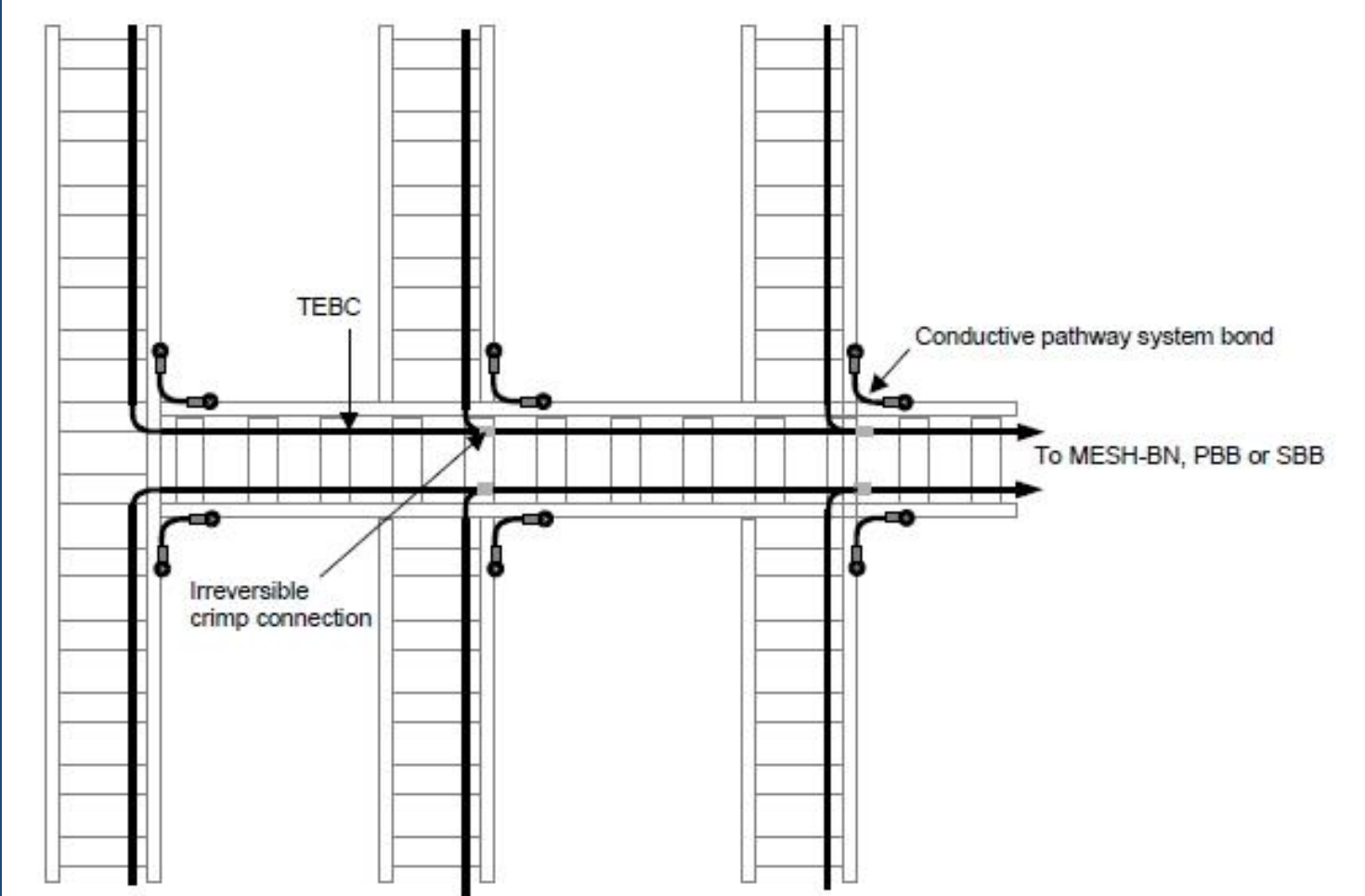
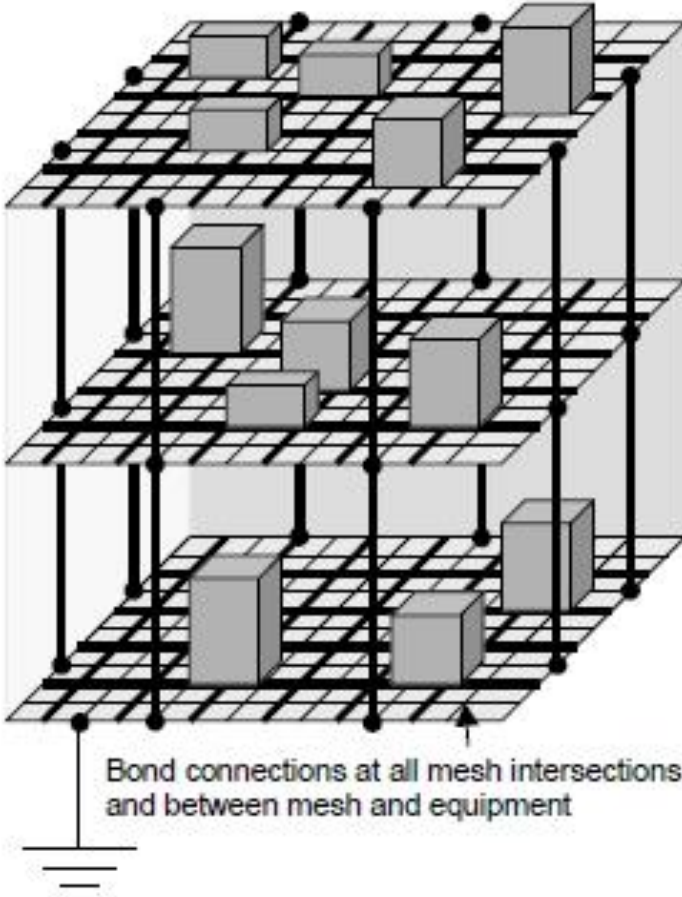


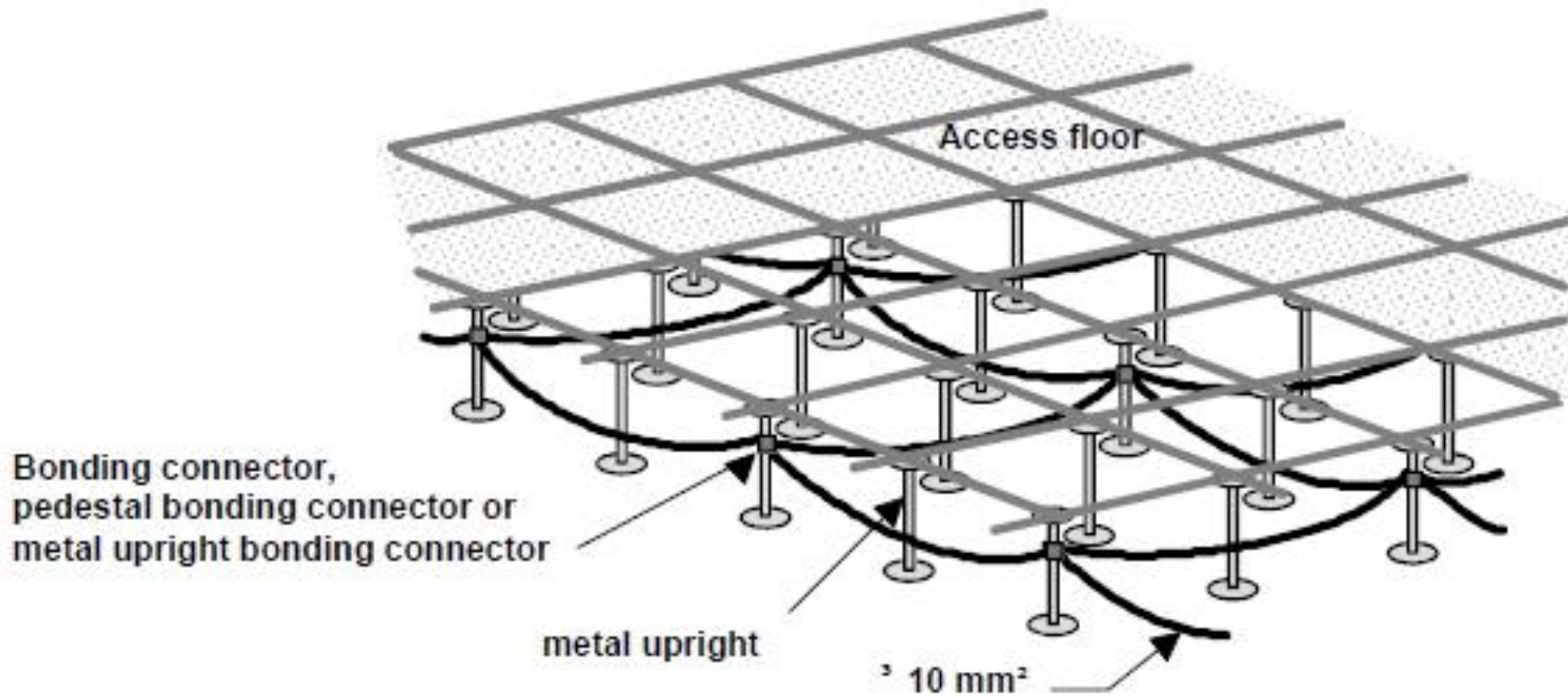
Figure 18 - Example of a TEBC routed on cable tray

# IEC 30129 draft – Figure 19



**Figure 19 - A MESH-BN with equipment cabinets, frames, racks and CBN bonded together**

# IEC 30129 draft – Figure 19



**Figure 21 - Example of access floor**

# Recognized Problems

- **Lingering myths of grounding & bonding**
- **WGs driven by marketing interests**
- **Migration of trade std to Int'l std status**
- **Commercial building is baseline layout**



# Lingering myths of grounding & bonding

- AC power faults require TBB to be “engineered” as an ac equip grd conductor
  - Also, TBB sized at 2 kcmil/ft (GTE Labs artifact)
- ITE requires increasingly stringent grounding
  - Bigger and/or more wires; “bonding grids”
- Grounding/bonding cures all ITE “ghost” operational problems

# Grounding & Bonding Industry Recognized as Misleading

Circuit  
Modeling  
for  
Electromagnetic  
Compatibility

Ian B. Darney

THE SCITECH SERIES ON ELECTROMAGNETIC COMPATIBILITY  
Alistair Duffy, PhD - Editor

## 1.7 Practical design techniques

Since the concepts of the 'equipotential ground', the 'single-point reference', and the advice to 'avoid earth loops' have acquired universal acceptance as critically important guidelines, the first three sections of Chapter 8 are devoted to an explanation as to why they are so misleading. The remaining sections identify many of the techniques employed by generations of designers to improve circuit immunity and reduce the level of unwanted emissions.

# Grounding & Bonding Industry Recognized as Misleading

## Circuit Modeling for Electromagnetic Compatibility

Ian B. Darney

THE SCITECH SERIES ON ELECTROMAGNETIC COMPATIBILITY  
Alistair Duffy, PhD - Editor

## 8.1 Grounding

Reliance on the use of the conducting structure as the universal return path for all signals and all supplies is probably the most prevalent cause of EMC problems. This could be due to the widespread belief in the existence of the equipotential ground plane. There is no such thing.

Ground planes are an extremely useful design feature of printed circuit boards and integrated circuits. But this does not mean that they are equipotential surfaces. Nor does it mean that a conductor designated as 'ground' or 'earth' is automatically a zero voltage reference point for all signals in the system.